

1 I/WE CLAIM:

2 1. A method of engine starting in a gas turbine engine
3 comprising:

4 rotating the engine to provide an air flow into a
5 combustor of the engine;

6 injecting fuel into the combustor at a varying rate
7 until the engine is lighted-off, the varying rate
8 being a function of time and represented by a curve
9 having at least one high frequency with respect to a
10 light-off time, representing instant changes of the
11 rate for intersecting a light-off zone while
12 reducing a quantity of fuel injected into the
13 combustor; and then,

14 continuously injecting fuel into the combustor to
15 accelerate the engine to a self-sustaining operation
16 condition.

17 2. A method as claimed in claim 1 wherein the curve
18 comprises a low frequency with respect to the light-off
19 time, representing a change trend of the varying rate.

20 3. A method as claimed in claim 2 wherein the curve has an
21 increasing trend and comprises an oscillatory profile.

22 4. A method as claimed in claim 2 wherein the curve has an
23 increasing trend and comprises a series of spikes.

1 5. A method as claimed in claim 2 wherein the curve has an
2 increasing trend and comprises a squared-off wave
3 profile.

4 6. A method as claimed in claim 2 wherein the curve has an
5 increasing trend and comprises a step profile.

6 7. A method as claimed in claim 2 wherein the engine is
7 rotated at a varying speed as a function of time.

8 8. A method as claimed in claim 6 wherein the engine is
9 rotated at an increasing speed.

10 9. A method as claimed in claim 2 further comprising
11 introduction of a predetermined first fuel flow level
12 into the combustor prior to fuel injection at the
13 varying rate.

14 10. A method as claimed in claim 9 further comprising:
15 selecting a minimum engine speed to begin the
16 introduction of the predetermined first fuel flow level
17 for starting the engine under a variety of altitude and
18 temperature conditions.

19 11. A method as claimed in claim 10 further comprising:
20 sensing a temperature of the fuel to be injected into
21 the combustor;
22 sensing a temperature of the air flow to be provided
23 into the combustor;
24 sensing a forward flight velocity ram quantity;

1 sensing an ambient air pressure;
2 sensing the varying speed of the engine; and
3 processing the sensed data to determine the minimum
4 engine speed for the introduction of the
5 predetermined first fuel flow level.

6 12. A method as claimed in claim 2 further comprising:
7 sensing a temperature of an exhaust gas flow to
8 determine if the light-off occurs.

9 13. A method as claimed in claim 2 further comprising:
10 biasing a profile of the curve representing the varying
11 fuel injection rate according to changes in the altitude
12 and temperature conditions.

13 14. A method as claimed in claim 2 further comprising:
14 changing the predetermined first fuel flow level
15 according to changes in the altitude and temperature
16 conditions.

17 15. A method as claimed in claim 11 further comprising:
18 measuring a light-off time taken from the beginning of
19 the introduction of the predetermined first fuel
20 flow level, to the occurrence of the light-off; and
21 storing the measured light-off time and the sensed data
22 in a database for reference in a future engine
23 starting process when a search shows no data
24 associated with an altitude and temperature
25 condition, similar to a current altitude and

1 temperature condition generated in a previous
2 light-off process and stored in the database.

3 16. A method as claimed in claim 15 further comprising:
4 changing a criterion of the minimum engine speed and the
5 predetermined first fuel flow level to reduce the
6 light-off time according to the stored data
7 associated with the similar altitude and temperature
8 condition, when such data is located in the
9 database; and

10 storing data regarding the changes and the light-off
11 time currently measured, and deleting the previously
12 stored data of the minimum engine speed and the
13 predetermined first fuel flow level and the
14 previously stored light-off time associated with the
15 similar altitude and temperature condition, when the
16 current light-off time is shorter than the
17 previously stored light-off time.